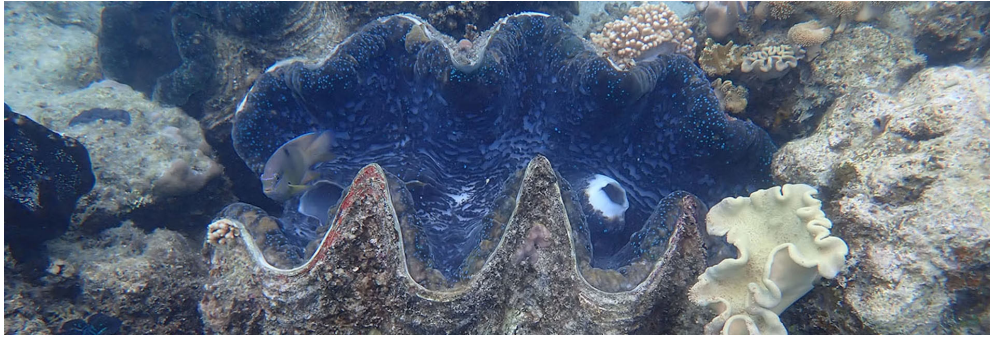


THE CONVERSATION

Academic rigour, journalistic flair



Giant Clam (*Tridacna gigas*) from Jiigurru (Lizard Island Group). Andy Lewis/Coral Sea Foundation

One giant clam contains a month-by-month diary of the Great Barrier Reef's climate 200 years ago

Published: September 29, 2026 9.49am AEST

<https://theconversation.com/one-giant-clam-contains-a-month-by-month-diary-of-the-great-barrier-reefs-climate-200-years-ago-290169>

When you swim through the azure waters of the Great Barrier Reef, there is one entity on the seafloor that's almost impossible to miss: the giant clam. Its huge, fluted shell frames a soft mantle shimmering with electric blue, green and gold.

As the world's largest living bivalve, *Tridacna gigas* can reach 1.2 metres, weigh more than 200 kilograms and live for over a century. Across their long lives, these clams record their daily life in their shells, creating an autobiographical shell diary.

In our new research, we read one of these shell diaries to reconstruct month-by-month climate conditions at Jiigurru (also known as the Lizard Island Group), in the northern Great Barrier Reef.

The shell's story reveals that, before widespread industrial-era warming, Jiigurru's summers were cooler than today, while winters were surprisingly similar.



Jiigurru (Lizard Island Group) showing Blue Lagoon where our giant clam recorded its shell diary. Sean Ulm

How can a shell keep a diary?

As a giant clam grows, the cycle of day and night produces microscopic daily lines in its shell, while the changing seasons produce broader annual bands. Like tree rings, these layers turn the shell into a diary.

The growth lines provide the dates, just as we date entries in our own diaries. The surrounding seawater writes the content by shaping the chemistry of each new layer.

Geochemistry is the language in which this climate diary is written. By reading that language, climate researchers can decode how the reef environment changed during the clam's long lifetime.

The missing southern record

Today, instruments on land, in the oceans and in space constantly measure the changing climate around the world. But these direct observations cover only a small slice of Earth's history. To look further back, researchers need to turn to other climate archives: records preserved in tree rings, corals, ice cores, lake and ocean sediments, and shells.

Yet many of the most detailed records before industrial-era warming come from the [Northern Hemisphere and from high latitudes](#). Tropical oceans in the Southern Hemisphere are much less well documented.

Giant clams live across the tropical Indo-Pacific. Their shells can add local, sub-seasonal resolution records to this missing southern story.

Reading the shell

Our study was done in partnership with the Walmbaar Aboriginal Corporation and Nguurruumungu Indigenous Corporation. Published in the journal *Global and Planetary Change*, it focused on a 58-centimetre giant clam shell collected from the lagoon at Jiigurru.

Jiigurru is a culturally important place for Dingaal and Ngurruumungu Aboriginal communities. [Archaeological excavations](#) at shell midden sites show at least 6,500 years of Aboriginal occupation.

[Radiocarbon dating](#) showed the clam lived between about 1785 and 1827, near the end of a pre-industrial cooling period known as the Little Ice Age. Under a microscope, we counted almost 10,900 daily growth lines, showing it lived for about 30 years.

We then drilled 784 tiny holes to take powder samples from shell layers. In each sample, we measured different forms of oxygen and carbon, called [isotopes](#).

The oxygen isotopes helped us estimate past sea temperatures. The carbon isotopes gave us clues about rainfall. Matching these chemical clues to the shell's growth structure gave us a month-by-month picture of the reef environment prior to industrial warming.

What the shell revealed

Compared with sea surface temperatures measured in the same lagoon from 1995 to 2015, our reconstruction showed that 225 years ago temperatures were 0.6–0.9°C cooler on average across the year. Summers were 0.9–1.2°C cooler, but winter temperatures were almost the same.

The shell diary told us more than just temperature.

Its carbon isotopes traced a clear rhythm between wetter and drier seasons. The temperature record also rose and fell in repeated two- to three-year cycles, consistent with local [El Niño-like and La Niña-like](#) variability.

The clam revealed that El Niño-like episodes (warmer, drier) were more common near the end of the 1700s. In the early 1800s, La Niña-like conditions (cooler, wetter) became more frequent and included the strongest events in the record.

A single average would miss all this detail. The month-by-month record shows how temperature changed through the seasons, how wet and dry conditions alternated through the year, and how climate shifted from one year to the next.

A wider Southern Hemisphere picture

Was Jiigurru an isolated case? Other records suggest not.

Corals [from elsewhere on the Great Barrier Reef](#) and [north-western Australia](#) also point to cooler seas or changes in ocean conditions.

[Antarctic ice](#) and [glacier](#) records show cooling and shifts in circulation around the same period.

Farther afield, other records point to La Niña-like conditions. [Galápagos corals](#) show frequent La Niña events during the early 1800s. [Cave records from northern Peru](#) indicate wetter Little Ice Age conditions. [Lakes in south-eastern Australia](#) were also higher in the early 1800s.

Seen together, these archives sketch a wider Southern Hemisphere story. Many places were cooler, while rainfall and ocean circulation shifted in different ways. But this was not one uniform event. The cooling at Jiigurru was smaller than many Northern Hemisphere estimates, showing why local records matter.

Our giant clam adds a rare month-by-month marine chapter to this broader Southern Hemisphere climate story. Similar shells from other Indo-Pacific reefs could show how these wider climate changes unfolded from place to place. Many more climate diaries may still be waiting inside giant clam shells.

Bohao Dong

Research Assistant, ARC Centre of Excellence for Indigenous and Environmental Histories and Futures, The University of Melbourne

Amy Prendergast

Associate Professor in The School of Geography, Earth and Atmospheric Sciences and Chief Investigator for the ARC Centre of Excellence for Indigenous and Environmental Histories and Futures, The University of Melbourne

Sean Ulm

Sean Ulm is a Friend of The Conversation.

Director, ARC Centre of Excellence for Indigenous and Environmental Histories and Futures, James Cook University

DOI

<https://doi.org/10.64628/AA.kjdqdjwte>